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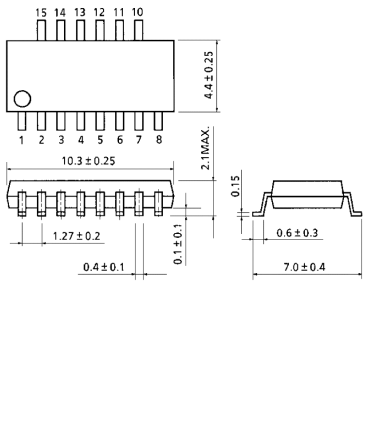
TOSHIBA Photocoupler GaAs Ired & Photo−MOS FET / Photo−Transistor

**TENTATIVE**

# TLP270D

Mobile / Note PCs
PDAs
Multimedia TVs
Modems

Unit in mm




TOSHIBA

Weight: 0.2g

TLP270D has many multi−functions in DAA circuits for modems, which is a fully integrated design photocoupler in a 14pin(SOP16).

(1) Photorelay
Dial pulsing switch, hookswitch
- 1 form A
- Peak off−state voltage: 200V (min.)
- Trigger LED current: 3mA (max.)
- On−state current: 150mA (max.)

(2) Photocoupler
Ring detection
- Collector−emitter voltage: 80V (min.)
- Current transfer ratio: 50% (min.)

(3) Darlington transistor
Electronic inductor
- Collector−emitter voltage: 30V (min.)
- Collector current: 150mA (max.)

(4) Bridge rectifier

Polarity protection

- Reverse voltage: 30V (min.)
- Forward voltage: 1.7V (max.)

(5) Zener diode

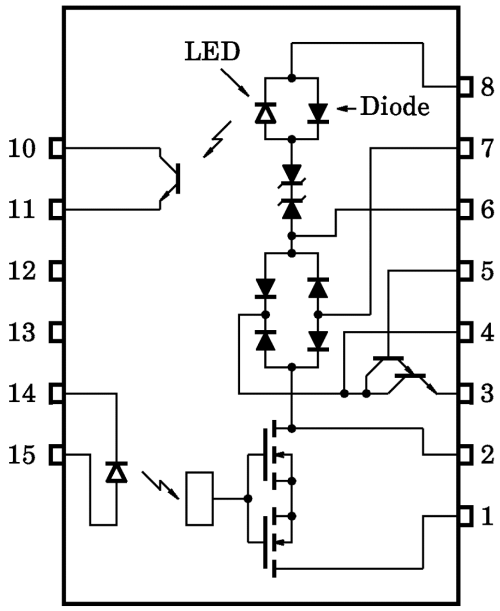
Ring detection protector

- Zener voltage: 22~32V

(Common)

- Isolation voltage: 1500Vrms (min.)
- UL recognized: UL1577, file No. E67349

## Pin Configuration (top view)




1 : MOSFET Drain
2 : MOSFET Drain / Bridge Rectifier Input
3 : Darlington Emitter
4 : Darlington Collector / Bridge Rectifier Output
5 : Darlington Base
6 : Bridge Rectifier Input / LED Anode (Diode Cathode)
7 : Bridge Rectifier Input
8 : LED Cathode / Diode Anode
10 : Photo Tr. Collector
11 : Photo Tr. Emitter
12 : NC
13 : NC
14 : LED Cathode
15 : LED Anode

## Photorelay(1−form−A)

### Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| LED | Forward current | $I_F$ | 50 | mA |
| | Forward current derating (Ta ≥ 25°C) | $\Delta I_F$ / °C | −0.5 | mA / °C |
| | Peak forward current (100μs pulse, 100pps) | $I_{FP}$ | 1 | A |
| | Reverse voltage | $V_R$ | 5 | V |
| | Junction temperature | $T_j$ | 125 | °C |
| Detector | Off−state output terminal voltage | $V_{OFF}$ | 200 | V |
| | On−state RMS current | $I_{ON}$ | 150 | mA |
| | On−state RMS current derating(Ta ≥ 25°C) | $\Delta I_{ON}$ / °C | −1.5 | mA / °C |
| | Junction temperature | $T_j$ | 125 | °C |

### Individual Electrical Characteristics (Ta = 25°C)

| Characteristic | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| LED | Forward voltage | $V_F$ | $I_F$=10mA | 1.0 | 1.15 | 1.3 | V |
| | Reverse current | $I_R$ | $V_R$=5V | — | — | 10 | μA |
| | Capacitance | $C_T$ | V=0, f=1MHz | — | 30 | — | pF |
| Detector | Off−state current | $I_{OFF}$ | $V_{OFF}$=200V | — | — | 1 | μA |
| | Capacitance | $C_{OFF}$ | V=0, f=1MHz | — | 90 | — | pF |

### Coupled Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Trigger LED current | $I_{FT}$ | $I_{ON}$=150mA | — | 1 | 3 | mA |
| On−state resistance | $R_{ON}$ | $I_{ON}$=150mA, $I_F$=5mA | — | 5 | 8 | Ω |

### Switching Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Turn−on time | $t_{ON}$ | $R_L$=200Ω, $V_{CC}$=20V, $I_F$=5mA | — | — | 1.5 | ms |
| Turn−off time | $t_{OFF}$ | | — | — | 1 | |

## Photocoupler (AC−input transistor output)

### Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| LED | Forward current | $I_F$ | ±50 | mA |
| | Forward current derating (Ta ≥ 25°C) | $\Delta I_F$ / °C | −0.5 | mA / °C |
| | Pulse forward current (100μs pulse,100pps) | $I_{FP}$ | 1 | A |
| | Junction temperature | $T_j$ | 125 | °C |
| Detector | Collector−emitter voltage | $V_{CEO}$ | 80 | V |
| | Emitter−collector voltage | $V_{ECO}$ | 7 | V |
| | Collector current | $I_C$ | 50 | mA |
| | Collector power dissipation (1 circuit) | $P_C$ | 150 | mW |
| | Collector power dissipation derating(Ta ≥ 25°C) (1 circuit) | $\Delta P_C$ / °C | −1.5 | mW / °C |
| | Junction temperature | $T_j$ | 125 | °C |

### Individual Electrical Characteristics (Ta = 25°C)

| Characteristic | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| LED | Forward voltage | $V_F$ | $I_F$=±10mA | 1.0 | 1.15 | 1.3 | V |
| | Capacitance | $C_T$ | V=0, f=1MHz | — | 60 | — | pF |
| Detector | Collector−emitter breakdown voltage | $V_{(BR)CEO}$ | $I_C$=0.5mA | 80 | — | — | V |
| | Emitter−collector breakdown voltage | $V_{(BR)ECO}$ | $I_E$=0.1mA | 7 | — | — | V |
| | Collector dark current | $I_D$ | $V_{CE}$=48V (ambient light: 100 lx) | —<br>— | 0.01<br>(2) | 0.1<br>(20) | μA |
| | | | $V_{CE}$=48V, $T_a$=85°C (ambient light: 100 lx) | —<br>— | 2<br>(4) | 50<br>(50) | μA |
| | Capacitance | $C_{CE}$ | V=0, f=1MHz | — | 10 | — | pF |

## Coupled Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Current transfer ratio (CTR) | $I_C / I_F$ | $I_F$=5mA, $V_{CE}$=5V | 50 | — | — | % |
| | | Rank GB | 100 | — | — | |
| Saturated CTR | $I_C / I_F$ (sat) | $I_F$=1mA, $V_{CE}$=0.4V | — | 60 | — | % |
| | | Rank GB | 30 | — | — | |
| Collector−emitter saturation voltage | $V_{CE(sat)}$ | $I_C$=2.4mA, $I_F$=8mA | — | — | 0.4 | V |
| | | $I_C$=0.2mA, $I_F$=1mA | — | 0.2 | — | |
| | | Rank GB | — | — | 0.4 | |
| Off−state collector current | $I_{C(off)}$ | $V_F$=0.7V, $V_{CE}$=48V | — | — | 10 | μA |

## Switching Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Rise time | $t_r$ | $V_{CC}$=10V, $I_C$=2mA, $R_L$=100Ω | — | 2 | — | μs |
| Fall time | tf | | — | 3 | — | |
| Turn−on time | $t_{on}$ | | — | 3 | — | |
| Turn−off time | $t_{off}$ | | — | 3 | — | |
| Turn−on time | $t_{ON}$ | $R_L$=1.9kΩ, $V_{CC}$=5V, $I_F$=16mA | — | 2 | — | |
| Storage time | $t_s$ | | — | 25 | — | |
| Turn−off time | $t_{OFF}$ | | — | 40 | — | |

## Zener Diode

## Individual Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Zener voltage | $V_Z$ | — | 22 | 27 | 32 | V |

## Darlington Transistor

### Maximum Ratings (Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Collector−base voltage | $V_{CBO}$ | 30 | V |
| Collector−emitter voltage | $V_{CEO}$ | 30 | V |
| Emitter−base voltage | $V_{EBO}$ | 10 | V |
| Collector current | $I_C$ | 0.15 | A |
| Base current | $I_B$ | 20 | mA |
| Collector power dissipation | $P_C$ | 350 | mW |
| Junction temperature | $T_j$ | 125 | °C |

### Individual Electrical Characteristics (Ta = 25°C)

| Characteristic | | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Collector off current | | $I_{CBO}$ | $V_{CB}$=30V, $I_E$=0 | — | — | 10 | μA |
| Emitter off current | | $I_{EBO}$ | $V_{EB}$=10V, $I_C$=0 | — | — | 10 | μA |
| Collector−emitter breakdown voltage | | $V_{(BR)CEO}$ | $I_C$=10mA, $I_B$=0 | 30 | — | — | V |
| DC current gain | | $h_{FE}$ | $V_{CE}$=2V, $I_C$=150mA | 4000 | — | — | |
| Collector−emitter saturation voltage | | $V_{CE(sat)}$ | $I_C$=0.15A, $I_B$=1mA | — | — | 1.5 | V |
| Switching time | Turn−on time | $t_{on}$ | $I_B$=1mA, $V_{CC}$=15V, $R_L$=15Ω | — | 0.20 | — | μs |
| | Storage time | $t_{stg}$ | | — | 0.6 | — | |
| | Fall time | $t_f$ | | — | 0.3 | — | |

## Bridge Rectifier

### Maximum Ratings (Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | 30 | V |
| Average output rectified current | $I_O$ | 0.15 | A |
| Peak one cycle surge forward current | $I_{FSM}$ | 0.5 | A |
| Junction temperature | $T_j$ | 125 | °C |

### Individual Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward voltage | $V_{FM}$ | $I_{FM}$=0.12A | — | — | 1.7 | V |
| Repetitive peak reverse current | $I_{RRM}$ | $V_{RRM}$=rated | — | — | 10 | μA |

## Package (common)

## Maximum Ratings (Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Total package power dissipation | $P_T$ | 650 | mW |
| Storage temperature range | $T_{stg}$ | −55~100 | °C |
| Operating temperature range | $T_{opr}$ | −20~85 | °C |
| Lead soldering temperature(10s) | $T_{sol}$ | 260 | °C |
| Isolation voltage (AC, 1min., R.H.≤ 60%) (Note 1) | $BV_S$ | 1500 | Vrms |

(Note 1): Device considered a two−terminal device: Pins1, 2, 3, 4, 5, 6, 7 and 8 shorted together and pins 10, 11, 12, 13, 14 and 15 shorted together.

## Isolation Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Capacitance input to output | $C_S$ | $V_S$=0, f=1MHz | — | 0.8 | — | pF |
| Isolation resistance | $R_S$ | $V_S$=500V, R.H.≤ 60% | $5 \times 10^{10}$ | $10^{14}$ | — | Ω |
| Isolation voltage | $BV_S$ | AC, 1 minute | 1500 | — | — | Vrms |
| | | AC, 1 second, in oil | — | 3000 | — | |
| | | DC, 1 minute, in oil | — | 3000 | — | Vdc |

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